NASA/GSFC/Suborbital & Special Orbital Projects Directorate

NASA Balloon Program Annex Form

This activity is being conducted under the Balloon Program Portfolio Project in support of the Suborbital Research Program (SRP)

Project Information

Date: August 9, 2016

Project Number: 820-CMPP-1606

Support:Name/Title: LDB Film and Systems Test

Mission Manager: J. Alan Haggard

Campaign Location: Fort Sumner, NM

Balloon Vehicle Information: 29.47MCF

Mission Profile: Pre-turnaround

Proposed Launch Window:

Start Date:	End Date:
August 29, 2016	October 15, 2016

Project Visibility

Does this have High Visibility? ☐ Yes ☒ No

If yes, briefly describe why:

Project Association

Support Element:

Associated BPO Development Project: ☐ Yes ☒ No

Or Is There an Associated NASA Center: ☒ Yes ☐ No

Langley Research Center, Goddard Space Flight Center

Project Funding:

Is project reimbursable ☐ Yes ☒ No

Funding Source: WFF BPO / CSBF

Budget: <200,000.00

Discipline: ***Test Flight***

Discipline Scientist: ***Vernon Jones***

Principal Investigator/Customer:

Name: Chris Field

Organization: Columbia Scientific Balloon Facility

Address: 1510 E. FM 3224
Palestine, TX 75803

Brief Description/summarize purpose of the activity, experiment package and objectives:

Provide a brief description to summarize the purpose of the activity, science and objectives:

This is an engineering test flight to test and validate a new balloon film as well as multiple types of flight hardware.
The primary objective is to validate a new balloon film (SF-530). This film is a three-layer, coextruded polyethylene film from Raven Engineered Film Division. Secondary objectives include:

- Fly a complete Support Instrumentation Package (SIP) with TDRSS functionality to test a high-gain TDRSS antenna (HGA) and a new low-cost TDRSS transceiver (LCT2).
- Fly a solar power system testing new "Boost" style charge controllers and a new double-circuit 15 cell x 2 solar panel
- Fly a NASA rotator with the new version 2.0 electronics.

Additionally, there will be six missions of opportunity on board:

- Micro Return Capsule (MIRCA) from Goddard Space Flight Center; PI is Jaime Esper.
  - MIRCA will determine in-situ atmospheric structure and composition of extra-terrestrial planets. Measure deceleration, pressure, temperature, and molecular content at several spots in atmosphere.
  - Drop test of planetary entry vehicle prototype to verify aerodynamic stability and recovery system approach (parachute).
- Stratospheric Infrasound Sensitivity Experiment (SISE) from Southwest Research Institute; PI is Eliot Young.
  - SISE will carry balloon-borne microphones to detect infrasound signatures from bolides (brighter than usual meteors,

particularly ones that explode; fireballs that are audible) and energetic terrestrial phenomena (earthquakes, volcanoes, tsunamis, etc.)
  - The objective of SISE is to characterize the near Earth object population from small bolides: size distribution, orbital elements, families of impactors, density, and strength properties.
- UNC-Sandia Infrasound Experiment (USIE) from U. North Carolina - Sandia National Laboratory; PI is Daniel Bowman.
  - Recent infrasound (low frequency sound) detector deployments as part of the High Altitude Student Platform (HASP) have revealed a surprisingly complex acoustic environment in the stratosphere. These signals, which have remained unsampled for the last half century, may originate from a diverse set of natural and human phenomena. However, critical questions remain about the origin and propagation of these signals, as well as the ability of stratospheric acoustic networks to detect them. USIE will add critical constraints to the design of free flying acoustic networks by recording infrasound from a set of ground explosions at the Energetic Materials Research and Testing Center (EMRTC) in Socorro, New Mexico.
- Cubes in Space™ (CiS) from NASA Langley Research Center; PI is Frank Peri.
  - CiS will fly a cube containing 100 student experiments. CiS is the only program in the world to provide students (ages 11-18) with a free, no-cost opportunity to design and build experiments to be launched into near space on a NASA scientific balloon.
  - The objective is to help children learn to problem-solve, to get them inspired about learning, and to learn skills and develop interests that will prepare them to succeed in the future. All students can benefit from a STEM-based education, regardless of gender, race, religion or nationality.
- Star Tracker (STTR) from Creare LLC; PI is Bob Kline-Schoder.
- Balloon-Borne HF Receiver (BBR) from Johns Hopkins University Applied Physics Laboratory; PI is Alex Chartier.
  - BBR will observe ionospheric parameters through HF transmissions from the WWV radio station, determining which signals reflect from the ionosphere, and ideally ascertaining the bottomside ionospheric density and height.

Launch Site: Fort Sumner, NM
Target Flight Ready Date: August 29
Balloon Volume: 29,470,000 ft3 (8,982,456 m3)
Balloon Special Requirements: None listed
Estimated Payload Weight: 3,050 lb
Ballast Type: Steel
Parachute: 130-ft diameter
Payload Dimensions: 6 ft L x 6 ft W x 8 ft H (1.8 m L x 1.8 m W x 2.4 m H)
Rotator: NASA rotator with new 2.0 electronics will be tested during this mission
Telemetry: Full LDB Support Instrumentation Package (SIP) with TDRSS and HGA at 300 Kbps; multiple Iridium transceivers, Iridium Pilot, and Micro Instrumentation Package (MIP) UHF transceivers
Gases/Cryogens: None
Flight Profile: Pre-turnaround

Balloon and Support System Success Criteria:

Please provide a brief description of the ***Balloon and Support System*** Minimum Success Criteria:

Float altitude: 118,000 ft (27.4 km)
Time at float altitude: 6 hours
Altitude stability: N/A

Please provide a brief description of the ***Balloon and Support System*** Comprehensive Success Criteria:

Float altitude: 120,000 ft (36.6 km)
Time at float altitude: 15 hours
Altitude stability: N/A

Science Success Criteria:

Please provide a brief description of the ***Science*** Minimum Success Criteria:

- High Gain Antenna and LCT2: Point to available TDRSS satellites and flow data at 6 Kbps
- Rotator w/2.0 Electronics: Point gondola sun side toward the sun for 2 hours
- LDB Electronics: LOS Data and command

Please provide a brief description of the ***Science*** Comprehensive Success Criteria:

- High Gain Antenna and LCT2: Maintain pointing and flow data at 300 Kbps
- Solar Power System (Boost CC and solar panel): Charge batteries during daylight hours
- Rotator w/2.0 Electronics: Control pointing of gondola throughout the flight
- LDB Electronics: TDRSS Data and command via Operations Control Center in Palestine

Specific Controls:

Control/Requirement	Yes/No	Details **Use Other information/Comments section if additional space is needed*
1. Are specific additional control plans required for this support?	No	
2. Are specific additional agreements required for this support?	No	
3. Is this part of a Research and Development Effort?	No	
4. Is there specific Project or Program documentation? "Detail"	Yes	CSBF Flight Requirements - completed prior to Flight Readiness Review
5. Is there specific Safety Documentation? "Detail"	Yes	Flight Safety Balloon Risk Analysis, Ft. Sumner, NM Balloon Campaign 2016 Flight Safety Plan, Ft. Sumner, NM Balloon Campaign 2016 Ground Safety Plan, Ft. Sumner, NM Balloon Campaign 2016
6. Are there schedule constraints that may impact the range support services being provided?	No	
7. Are there technical constraints that may impact the range support services being provided?	No	
8. Is an optional Key Decision Point (KDP) required?	No	
9. Are specific additional reviews required?	No	
10. Are there any unique safety items that the range needs to be cognizant of?	No	Ground Safety requirements are fully documented in the GSP and RAR.
11. Are there any additional quality assurance activities that will be implemented as part of the range support services provided?	No	
12. Are there special or unique Ground Safety Requirements?	No	
13. Are there special or unique Range and/or Flight Safety Requirements?	No	
14. Are there hazardous systems?	No	
15. Are there specific Science Hazardous Procedures?	No	Hazardous operations will be overseen by OSS and have been mitigated to an acceptable level to not require Safety-approved procedure.
16. Are there any external project specific control procedures or process flowed down for use? If yes, please list.	No	

Control/Requirement	Yes/No	Details **Use Other information/Comments section if additional space is needed*
17. Are there any specific environmental issues? Identify any specific environmental permit obtained.	Yes	In accordance with the National Environmental Policy Act, this mission will be conducted in compliance with the NASA Scientific Balloon Program Programmatic Environmental Assessment, established September 2010, which is in accordance with the National Environmental Policy Act. The planned mission design will maximize the opportunity for balloon carcass and payload recovery from the environment. Only slight surface disturbance is expected from the impact of the balloon carcass and payload.
18. Is there a first use item? If yes, please identify.	Yes	All of the payloads of opportunity with the exceptions of MIRCA and Cubes in Space are first use items. In MIRCA, the parachute is a first use item.

Other Information/Comments:

Please provide any other information/comments deemed appropriate

Test flights and missions of opportunity are considered expendable for the purposes of mishap cost estimates.

Accepted Risks:

In accordance with baseline programmatic implementation and in agreement with the undersigned stakeholders, accepted risks shall include but are not limited to:launch abort;failure of the balloon during the launch, ascent, or float phases;failure of support equipment or instrumentation;failure of test equipment or instrumentation;recoverable damage to support or test equipment prior to or during the launch process; andunrecoverable damage or destruction to support or test equipment due to test mission operations, environmental, and/or safety constraints.

Incidents that are considered accepted risks will be investigated under Suborbital Anomaly Investigation and Reports (800-PG-8621.0.1) and Investigating and Reporting Procedures for Balloon Program Mishaps, Failures and Anomalies (820-PG-8621.1.1).

Mishaps, as defined by NPR 8621.1 and separate to the predefined accepted risks, shall include but are not limited to occupational injury to NASA personnel; injury to non-NASA personnel and/or damage to public or private property caused by NASA operations and the destruction of NASA property.

Identify any ***Additional or Specific Accepted Risks***:

none at this time

Total System Hazardous Procedures and Responsibilities:

HAZARD	OWNER	USE	CHECKLIST NUMBERS	ADDITIONAL MITIGATIONS	OVERSIGHT
High voltage					
High pressure	CSBF	Ground System	OF-322-15-C, OF-434-00-C	OSS Checklist	OSS
Lifting	CSBF	Ground System		OSS Checklist	OSS
Pyrotechnics	CSBF	Flight System	ES-100-20-P	OSS Checklist	OSS
Stored Energy	CSBF	Flight System	OF-603-02-C	OSS Checklist	OSS
Launch Operation	CSBF	Ground System	ES-100-20-P, OF-322-15-C, 820-FORM-2010-6	MM/RSO Launch Authority	MM/RSO/OSS
Legend:	*Safety Oversight Not Required*		*OSS Oversight Required*	*OSS/RSO Oversight Required*	

Planned Reviews:

☐	Weekly team meetings	☐	Pre-Ship Review	☐	Launch Readiness Review	☒	Pre-Mission Briefing
☐	Biweekly team meetings	☐	Schedule Credibility Review	☒	Range Readiness Review	☒	Pilot Briefing (airfield ops)

☐	Monthly team meetings	☒	Requirements Review	☒	Approval To Proceed	☒	Post Mission Debrief
☐	Periodic Review	☒	Flight Readiness Review	☒	Daily Operations Debrief	☐	Other:

Identify any additional review information here if applicable:

FY2016 Mission Readiness Review

Lessons Learned:

Please provide a brief description of how lessons learned will be captured and processed

The Mission Manager will capture and collect Lessons Learned from science, CSBF, and NASA. Lessons Learned will be entered into a database and resolved as required.

Metrics:

Please provide a brief description of any metrics you are measuring for this effort and identify their storage location

n/a

Signatures:

Requestor:

J. Alan Haggard

Electronic Signature/ Date: JESS HAGGARD

Digitally signed by JESS HAGGARD
DN: c=US, o=U.S. Government, ou=NASA, ou=People, cn=JESS HAGGARD, 0.9.2342.19200300.100.1.1=ahaggard
Date: 2016.08.09 16:35:24 -04'00'

Comments/Modifications/Redlines to Request:

None

CSBF Operations Manager

Electronic Signature/ Date: Hugo Franco

Digitally signed by Hugo Franco
DN: cn=Hugo Franco, o=CSBF, ou=Operations, email=Hugo.Franco@csbf.nasa.gov, c=US
Date: 2016.08.10 08:32:27 -05'00'

Comments/Modifications/Redlines to Request

None

CSBF Site Manager

Electronic Signature/ Date: Dwayne Orr

Digitally signed by Dwayne Orr
DN: cn=Dwayne Orr, o=Orbital ATK, ou=CSBF, email=dwayne.orr@csbf.nasa.gov, c=US
Date: 2016.08.10 14:44:08 -05'00'

Comments/Modifications/Redlines to Request

None

Principal Investigator

Electronic Signature/ Date:

Chris Field

Digitally signed by Chris Field
DN: cn=Chris Field, o=Orbital ATK, ou=CSBF, email=christopher.j.field@nasa.gov, c=US
Date: 2016.08.12 09:23:49 -05'00'

Comments/Modifications/Redlines to Request

None

BPO Mission Operations Manager

Electronic Signature/ Date:

GABRIEL GARDE

Digitally signed by GABRIEL GARDE
DN: c=US, o=U.S. Government, ou=NASA, ou=People, cn=GABRIEL GARDE, 0.9.2342.19200300.100.1.1=ggarde
Date: 2016.08.12 11:21:17 -04'00'

Comments/Modifications/Redlines to Request

None

BPO Contracting Officer's Representative

Electronic Signature/ Date:

GABRIEL GARDE

Digitally signed by GABRIEL GARDE
DN: c=US, o=U.S. Government, ou=NASA, ou=People, cn=GABRIEL GARDE, 0.9.2342.19200300.100.1.1=ggarde
Date: 2016.08.12 11:22:02 -04'00'

Comments/Modifications/Redlines to Request

None

Assistant Chief, BPO Code 820

Electronic Signature/ Date:

DAVID GREGORY

Digitally signed by DAVID GREGORY
DN: c=US, o=U.S. Government, ou=NASA, ou=People, cn=DAVID GREGORY, 0.9.2342.19200300.100.1.1=dgregory
Date: 2016.08.15 15:52:27 -04'00'

Comments/Modifications/Redlines to Request

None

Chief, WFF Safety Office

Electronic Signature/ Date:

Comments/Modifications/Redlines to Request

None

Chief, BPO, Code 820

Electronic Signature/ Date:

Comments/Modifications/Redlines to Request

None